4. LOW-LEVEL WASTE

4.1 INTRODUCTION

As used in this chapter, low-level waste (LLW) has the same meaning as in The Low-Level Waste Policy Act (Pub. L. 95–573, Dec. 22, 1980). Namely, LLW is radioactive waste not classified as high-level radioactive waste (HLW), transuranic waste (TRUW), spent nuclear fuel (SNF), or by-product material specified as uranium or thorium tailings and waste. Tailings (viz., mill tailings) are considered in Chapters 5 and 6. Another waste classification not delineated in this chapter is "mixed" low-level waste (MLLW), which contains both chemically hazardous and radioactive constituents (Chapter 8). Specific definitions of these waste types (as defined by DOE Order 5820.2A) are given in the glossary of this report. DOE generates LLW through its defense activities, naval nuclear propulsion program, and various research and development (R&D) activities. The data for DOE sites represent a summary of information obtained from each site.[1]

Disposal of LLW at commercial sites accounted for about 32 vol % of all LLW disposed at end of fiscal year (EOFY) 1996. In this chapter, commercial sites exclude the Envirocare site, which is treated separately because it has not only commercial and DOE wastes, but also wastes from activities sponsored by other (non-DOE) federal agencies. Commercially disposed LLW is generally divided into five categories: academic, government, industrial, medical, and utility.[2] The academic category includes university hospitals and university medical and nonmedical research facilities. The government category includes state and non-DOE federal agencies. The industrial category is comprised of private entities such as R&D companies, manufacturers, nondestructive-testing operations, mining works, fuel fabrication facilities, and radiopharmaceutical manufacturers. The medical category includes hospitals and clinics, research facilities, and private medical offices. The utility category includes commercial nuclear reactors. In earlier revisions of the IDB report, commercially disposed waste was reported by fuel cycle and industrial/institutional (I/I) type activities. However, to achieve more consistency with other reporting agencies, the five categories previously described were used, starting with Rev. 9 of the IDB report.

Some LLW is also disposed of at the Envirocare facility located in Clive, Utah. Envirocare is a commercially operated facility that disposes of LLW, MLLW, naturally occurring and accelerator-produced radioactive material (NARM), and 11e(2) by-product material for both federal and private customers (see Table 0.8 in Chapter 0 of this report). The volume of LLW disposed of at Envirocare is presented in Table 4.1. Radioactivity data were not available. Envirocare accounted for about 4 vol % of all of the LLW disposed by the EOFY 1996.

Some LLW is also generated by DOE environmental restoration programs (see Chapter 6). Other LLW will be generated by nonroutine D&D operations. Waste from past commercial D&D operations is included in the disposed commercial waste inventories reported in this chapter.

The categorization of LLW according to DOE and commercial activities permits a comparison of the radioactivity levels and volumes of waste arising from each of these major sources (Figs. 4.1 and 4.2). Envirocare is not included in the comparisons presented in Fig. 4.1 since data for that site's LLW radioactivity were not available. Summary data on LLW disposal are given in Table 4.1. Historical and projected annual data for disposed DOE LLW are presented in Table 4.2. Similar data are shown for disposed commercial LLW in Table 4.3.

4.2 DOE LLW

4.2.1 Inventories of LLW at DOE Sites

An abridged picture of DOE LLW inventories, projections, and characteristics through EOFY 1996 is given in Figs. 4.1–4.4, as well as Tables 4.1, 4.2, and 4.4–4.16. The data in these tables are derived from DOE site responses to the DOE Office of Environmental Management (DOE/EM) Technical Information Collection Database.[1] As reflected in the tables, DOE LLW data can be grouped into three major areas: generation, storage, and

disposal. Summaries of DOE site-generated LLW volumes are presented in Tables 4.6, 4.8, and 4.9. Table 4.10 provides summary volumes of LLW-contaminated media in storage at DOE sites.

A summary of DOE LLW disposed volume is presented in Tables 4.1, 4.2, 4.4, 4.7, 4.11, and 4.13. Before October 1979, some LLW generated by DOE contractors was shipped to commercial disposal sites. The volume and radioactivity data for DOE LLW that were shipped to commercial disposal sites are contained in the commercial LLW tables of this chapter. Currently, LLW generated by DOE activities is generally disposed of at DOE sites (see Figs. 4.3 and 4.4).

Small quantities of DOE LLW have been disposed of by dumping the LLW into the sea or by hydrofracture.[3] Table 4.12 shows the estimated quantity and radioactivity of LLW disposed of by these methods. Dumping of LLW into the sea was halted by the United States in 1970, and hydrofracture was terminated in 1983.

4.2.2 Characterization of LLW at DOE Sites

Based on information reported in ref. 1, summaries of the characteristics of DOE LLW by matrix parameter category (MPC) are reported in Tables 4.6–4.9 and 4.11. Table 4.5 provides definitions of each of the MPC codes used in the tables. For DOE site activities sponsored by the Office of Waste Management (EM-30), this breakdown provides a detailed description of the LLW that has been generated or disposed. However, the DOE Environmental Restoration Program (EM-40) has large volumes of LLW currently in storage (such as unsolidified sludges and residues) which do not fit into the categories described in Table 4.5. A breakdown of this data, by DOE site, is provided in Table 4.10.

In addition to shallow-land burial, DOE LLW has been disposed by dumping wastes into the sea and hydrofracture (Table 4.12). Most of the DOE wastes that were dumped into the sea were incorporated into cement matrix material and packaged in steel drums (55- or 80-gal capacity). Hydrofracture was developed at ORNL for the permanent disposal of locally generated, low-level (approximately 0.25 Ci/L) liquid waste concentrates.[4] Waste was mixed with a blend of cement and other additives, and the resulting grout was injected into shale at depths of 200 to 300 m. The injected grout hardened into thin, horizontal sheets several hundred meters wide.

4.2.3 DOE LLW Projections

LLW generation and disposal projections reported by DOE sites are presented in Tables 4.6 and 4.7, respectively, for three fiscal-year (FY) time periods: 1997, 1998–2006, and 2007–2030. The data presented in Tables 4.6 and 4.7 represent the total LLW generation or disposal, respectively, during each of the three periods.

The projected disposal data (Table 4.7), combined with actual 1996 (Table 4.7) and historical (ref. 5) disposal data, were used to calculate historical and projected volume, radioactivity, and thermal power of DOE-disposed LLW. LLW data were collected by a different breakdown in previous revisions of the IDB report (Revs. 1–10). Historical disposal data through 1993 were decayed from the year of addition through the year 2030 using the representative radionuclide compositions[6] given in Table A.2 of Appendix A. Beginning with 1994, disposal data were decayed from the year of addition through 2030 using radionuclide compositions provided by each disposal site in the data call for Rev. 11 of this report. Disposed radioactivity data for 1996–2030 were not available.[1] Consequently, radioactivity values based on historical disposals were estimated for this time period.

Projected volume, radioactivity, and thermal power for disposed DOE LLW are presented in Tables 4.2 and 4.13–4.16. Table 4.2 reports projections of total disposed DOE LLW (summarizing Tables 4.13–4.16), while Table 4.13 summarizes all disposed DOE LLW except LLW that results from final HLW form production. Contributions from the latter are reported separately for each of three DOE sites in Tables 4.14–16. Projections of the characteristics of low-activity waste (LAW) generated from Hanford tank HLW immobilization activities are provided in Table 4.14. Corresponding projections for LLW grout produced from INEEL HLW immobilization activities are reported in Table 4.15, which is followed by Table 4.16, which summarizes projections of saltstone, a LLW by-product from the solidification of HLW at SRS. As shown in Fig. 2.7 in Chapter 2, saltstone is to be stored in concrete vaults at SRS. HLW immobilization is also taking place at the West Valley Demonstration Project (WVDP), but the quantity of LLW being generated from the immobilization is not significant.

4.3 COMMERCIAL LLW

4.3.1 Inventories at Commercial LLW Disposal Sites

There are six commercial shallow-land disposal sites for LLW (Figs. 4.2, 4.5, and 4.6), but only two are currently in operation: Barnwell, South Carolina, and Richland, Washington. Commercial operations at the Maxey Flats, Kentucky; West Valley, New York;

Sheffield, Illinois; and Beatty, Nevada, sites have been halted. Until 1986, a second NRC-licensed burial ground at West Valley continued to receive wastes generated on-site from cleanup and water-treatment operations. However, disposal operations at the WVDP have been suspended since 1986 pending the preparation of an environmental impact statement (EIS) report for the West Valley site closure. The historical data for annual additions and inventories of volume and radioactivity (undecayed) at each commercial disposal site through the EOFY 1996 are listed in Tables 4.17 and 4.18, respectively (compiled from refs. 5 and 7). The volumes are depicted in Figs. 4.2, 4.5, and 4.6. Sources of the historical reported data through 1984 are given in ref. 3, and those through 1994 are given in ref. 5. Quantities of LLW shipped to disposal sites during 1996 (Jan. 1–Sept. 30) are listed in Table 4.19 on a state-by-state basis.[7] Table 4.20 provides a breakdown of waste received at Barnwell and Richland in 1996 (Jan. 1—Sept. 30) by category (i.e., academic, government, industrial, medical, or utility LLW).

Table 4.3 is a summary of historical and projected volumes, radioactivity (decayed), and thermal power for commercial LLW. Projections are made only through 2005 because of large uncertainties in commercial disposal facility operations. Included in Table 4.3 are contributions from the drums of cemented LLW (totaling over 5,000 m^3) generated by the WVDP as a result of the vitrification of HLW. Table 4.3 does not include contributions from LLW disposed of at the Envirocare disposal facility near Clive, Utah. Additional information on Envirocare disposals can be found in Table 0.8 of Chapter 0.

4.3.2 Characterization of LLW at Commercial Disposal Sites

All of the LLW accepted for commercial disposal is categorized as Class A, B, or C in compliance with NRC specifications.[8] The LLW that exceeds these specifications is currently in storage at the generator site or at a DOE site which has accepted it for study (see Sect. 4.3.3). A calculated representative radionuclide composition for disposed commercial LLW is given in Table A.3 of Appendix A. This composition is periodically updated to reflect changes in waste management practices and in the regulations governing LLW disposal.

4.3.3 Greater-Than-Class-C (GTCC) LLW

In 1980, federal law made each state responsible for providing the disposal capacity for LLW generated within its borders, except for certain waste generated by the federal government.[9] In 10 CFR Part 61 (ref. 8), the NRC codifies disposal requirements for three classes of LLW, as mentioned above, generally suitable for near-surface disposal, namely, Class A, B, and C (with Class C waste requiring the most rigorous disposal specifications). Waste with concentrations above Class C limits for certain short- and long-lived radionuclides (i.e., GTCC LLW) was found not generally suitable for near-surface disposal, except on a case-by-case evaluation of the waste and the proposed disposal method by NRC or state licensing agency. The Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA)[10] made the states responsible for the disposal of Classes A, B, and C LLW and made the federal government (viz., DOE) responsible for disposal of GTCC LLW. The law also required that GTCC LLW generated by licensees of NRC be disposed of in a facility licensed by NRC. The projected amounts of GTCC LLW are uncertain, both because of regulatory uncertainties affecting the definition of HLW (i.e., a clearly defined all-inclusive list of wastes considered HLW may include more than those described in Chapter 2) and because of limited information on the sources, volumes, and characteristics of GTCC LLW.[11]

In May 1989, NRC promulgated a rule that requires disposal of GTCC LLW in a deep geologic repository unless disposal elsewhere has been approved by NRC. The rule as amended states: "Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different and, in general, more stringent than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission."[12] A disposal facility (other than a deep geologic repository) for GTCC LLW will probably not be available for several decades because of the complexities of siting and of NRC licensing. A generic description of estimated sources and forms of GTCC LLW is presented in Table A.4 of Appendix A.

In 1994, DOE revised an earlier study to provide information about estimates of current and future GTCC LLW to the year 2035 (2055 in some instances). Information garnered during the study[13] includes identification of generators, waste form characteristics, volumes, and radionuclide activities. The study categorizes GTCC LLW as (1) nuclear utilities waste, (2) sealed-sources waste, (3) DOE-held potential GTCC LLW, and (4) other generator waste. Various scenarios for data projection were used: (a) unpackaged volumes; (b) packaged volumes based on the application of packaging factors to the unpackaged volumes; and (c) concentration averaging, mixing, or blending of similar

materials with different radionuclide concentration values applied to the packaged volumes. Each of the three scenarios is treated for three cases: low, base, and high.

Based on base-case projections of after-concentration-averaged-packaged waste to the year 2035, the study determined that the largest volume of GTCC wastes (approximately 53%) is generated by nuclear power plants. The "other" generator waste category contributes approximately 31% of the total GTCC LLW volume projected to the year 2035. Sealed sources are about 16% of the total projected volume of GTCC LLW. A summary of historical and projected cumulative volume and radioactivity for GTCC LLW is presented in Table 4.21.

4.3.4 Commercial LLW Disposal Sites

Of the six commercial LLW disposal sites, only two remain open: Barnwell and Richland. Historical information regarding commercial LLW facilities can be found in previous editions of the IDB report. Closure dates for the four closed facilities are presented in the footnotes of Tables 4.17 and 4.18.

The Barnwell, South Carolina, disposal site is operated by Chem-Nuclear Systems, Inc. During the first 9 months of CY 1996, Barnwell received 73 vol % of the total volume of commercial LLW shipped for disposal. Barnwell was scheduled to restrict access to Southeast compact members starting July 1, 1995; however, the state of South Carolina withdrew from the Southeast compact. As a result, Barnwell is open for disposal to all states with the exception of North Carolina.

The Richland, Washington, disposal site is operated by U.S. Ecology, Inc. During the first 9 months of CY 1996, Richland received about 27 vol % of the total volume of commercial LLW shipped for disposal. Richland accepted wastes only from member states of the Northwest and Rocky Mountain compacts (Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, and Wyoming).

4.3.5 Commercial LLW Projections

This report presents summary information for disposed commercial waste. Historical volume, radioactivity, and thermal power data through 1979 are taken from an earlier version of this report (DOE/RW-0006, Rev. 8). After 1979, the source term for commercial LLW in Table A.3 of Appendix A is used to decay the annual waste additions to the commercial sites.

Projections for disposed commercial LLW are made only through 2005 because of uncertainties in current facility operations and the availability of future sites. Neither Barnwell nor Richland have a published closure date.[7] As a result, for projections, the disposal rates for 1997–2005 are assumed to be the same. Historical and projected volume, radioactivity, and thermal power for disposed commercial LLW are presented in Table 4.3.

4.4 REFERENCES

1. U.S. Department of Energy, Office of Environmental Restoration, Office of Waste Management, *Technical Information Collection Database*, updated through Oct. 30, 1997.

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3. U.S. Department of Energy, *Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics*, DOE/RW-0006, Rev. 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee (December 1985).

4. U.S. Energy Research and Development Administration, Environmental Impact Statement, *Radioactive Waste Facilities*, WASH-1532 (Draft), Oak Ridge National Laboratory, Oak Ridge, Tennessee (January 1974).

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6. C. W. Forsberg, W. L. Carter, and A. H. Kibbey, *Flowsheets and Source Terms for Radioactive Waste Projections*, ORNL/TM-8462, Oak Ridge National Laboratory, Oak Ridge, Tennessee (March 1985).

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8. U.S. Nuclear Regulatory Commission, "Licensing Requirements for Land Disposal of Radioactive Wastes," *Code of Federal Regulations*, 10 CFR Part 61, Jan. 1, 1997.

9. U.S. Congress, The Low-Level Radioactive Waste Policy Act, Pub. L. 95–573, Dec. 22, 1980.

10. U.S. Congress, The Low-Level Radioactive Waste Policy Amendments Act of 1985, Pub. L. 99–240, Jan. 15, 1986.

11. U.S. Department of Energy, *Recommendations for Management of Greater-than-Class-C Low-Level Radioactive Waste*, DOE/NE-0077, Washington, D.C. (February 1987).

12. U.S. Nuclear Regulatory Commission, amendments to 10 CFR Part 61, "Disposal of Radioactive Wastes," Final Rule, *Fed. Regist*. **54**(100), 22578–83 (May 25, 1989).

13. Lockheed Idaho Technologies Company, *Greater-Than-Class-C Low-Level Radioactive Waste Characterization: Estimated Volumes, Radionuclide Activities, and Other Characteristics*, DOE/LLW-114, Rev. 1, Idaho Falls, Idaho (September 1994).

Table 4.1. Summary of characteristics for disposed LLW as of EOFY 1996

Category	Volume (10^3 m^3)		Radioactivity (10^3 Ci)		Thermal power (W)	
	Annual[a]	Cumulative	Annual	Cumulative	Annual	Cumulative
DOE sites[b]	33.7	3,045	245	12,148	1,331	22,022
Commercial sites[c]	15.2	1,545	377	5,136	1,905	19,917
Envirocare[d]	44.3[e]	200	f	f	f	f
Total	93.2	4,790	622	17,284	3,236	41,939

[a]Addition during FY 1996.

[b]Excludes contributions of LLW from final HLW form production.

[c]Includes contributions from Beatty, West Valley, Maxey Flats, Richland, Sheffield, and Barnwell sites.

[d]Envirocare is a commercially operated facility that disposes of LLW, MLLW, NARM, and 11e(2) by-product material for both federal and private customers. See Table 0.8 in Chapter 1.

[e]Contribution during the period Jan. 1–Sept. 30, 1996.

[f]Unavailable.

Table 4.2. Historical and projected volume, radioactivity, and thermal power of disposed DOE LLW[a]

End of year[b]	Volume (10^3 m^3)		Radioactivity (10^3 Ci)		Thermal power (W)	
	Annual	Cumulative	Annual	Cumulative[c]	Annual	Cumulative
1990	60.0	2,759	545	13,516	2,013	17,844
1991	53.6	2,812	717	13,277	2,788	18,220
1992	48.3	2,860	1,078	13,401	4,947	20,741
1993	50.5	2,911	894	13,147	3,263	20,398
1994	52.1	2,963	621	12,858	3,463	21,534
1995	48.5	3,011	422	12,550	2,378	22,195
1996	34.2	3,068	245	12,148	1,333	22,024
1997	35.0	3,103	472	12,032	2,602	23,253
1998	52.7	3,156	373	11,827	2,162	23,914
1999	66.1	3,222	374	11,635	2,159	24,487
2000	55.7	3,277	374	11,453	2,155	24,973
2001	51.6	3,329	374	11,280	2,150	25,373
2002	54.2	3,384	571	11,313	2,697	26,251
2003	55.0	3,439	567	11,346	2,679	27,041
2004	53.5	3,492	562	11,377	2,663	27,760
2005	55.9	3,548	558	11,408	2,650	28,416
2006	54.9	3,603	554	11,438	2,637	29,016
2007	47.7	3,651	432	11,352	1,899	28,837
2008	46.4	3,697	428	11,283	1,888	28,720
2009	47.9	3,745	424	11,228	1,878	28,635
2010	45.7	3,791	420	11,184	1,867	28,578
2011	45.9	3,836	416	11,148	1,856	28,542
2012	58.7	3,895	981	11,687	3,444	30,121
2013	64.1	3,959	1,331	12,574	4,426	32,668
2014	64.3	4,024	1,306	13,421	4,358	35,110
2015	65.5	4,089	1,281	14,233	4,290	37,450
2016	63.2	4,152	1,258	15,009	4,225	39,685
2017	64.0	4,216	1,235	15,749	4,162	41,820
2018	63.5	4,280	1,212	16,456	4,099	43,850
2019	39.5	4,319	1,190	17,128	4,038	45,791
2020	41.5	4,361	1,161	17,760	3,926	47,588
2021	40.8	4,402	1,140	18,364	3,867	49,287
2022	19.0	4,421	247	18,063	1,360	48,438
2023	19.1	4,440	247	17,773	1,360	47,629
2024	19.1	4,459	247	17,494	1,360	46,851
2025	19.1	4,478	247	17,222	1,360	46,080
2026	19.5	4,497	247	16,962	1,360	45,338
2027	19.5	4,517	247	16,710	1,360	44,613
2028	19.8	4,537	247	16,466	1,360	43,915
2029	20.3	4,557	247	16,232	1,360	43,233
2030	20.3	4,577	247	16,004	1,360	42,567

[a]Summation of values in Tables 4.13 (buried DOE LLW, except LLW from final HLW form production) and 4.14–4.16 (LLW from final HLW form production).

[b]Historical data prior to 1996 are expressed on an EOCY basis.

[c]The radioactivity added each year for each waste type is decayed as described in the footnotes of Tables 4.13.

Table 4.3. Historical and projected volume, radioactivity, and thermal power of commercial LLW shipped for disposal[a]

End of year	Volume (10^3 m^3)		Radioactivity (10^3 Ci)		Thermal power (W)	
	Annual	Cumulative	Annual	Cumulative[b]	Annual	Cumulative
1990	33.5	1,387	549	4,979	2,774	16,457
1991	38.8	1,426	800	5,272	4,044	18,424
1992	49.8	1,476	1,000	5,708	5,057	21,117
1993	23.4	1,499	643	5,709	3,252	21,627
1994	25.0	1,524	751	5,841	3,799	22,746
1995	19.9	1,544	172	5,376	869	20,815
1996[c]	7.0	1,551	288	5,136	1,455	19,917
1997[d]	9.4	1,560	384	5,030	1,940	19,643
1998	9.4	1,570	384	4,930	1,940	19,481
1999	9.4	1,579	384	4,856	1,940	19,206
2000	9.4	1,588	384	4,787	1,940	19,053
2001	9.4	1,598	384	4,727	1,940	18,937
2002	9.4	1,607	384	4,677	1,940	18,853
2003	9.4	1,617	384	4,633	1,940	18,798
2004	9.4	1,626	384	4,595	1,940	18,767
2005	9.4	1,635	384	4,562	1,940	18,757

[a]Includes LLW disposed of at the following commercial sites: Beatty, Nevada; West Valley, New York; Maxey Flats, Kentucky; Richland, Washington; Sheffield, Illinois; and Barnwell, South Carolina. Contributions for West Valley include over 5,000 m^3 generated during CY 1987 through CY 1995 as a result of preparation activities for HLW vitrification.

[b]The radioactivity through 1979 was decayed using a multiple source term methodology (see Tables 4.3 and 4.20–4.25 of Rev. 8 of this report for a description of this method). After 1979, the radioactivity is decayed from the year of addition using the representative compositions given in Table A.3 of Appendix A.

[c]Data presented are for Jan. 1, 1996, to Sept. 30, 1996, to adjust to a FY basis. Years prior to 1996 are calendar years.

[d]Projections were made based on disposal operations at Richland, Washington, and Barnwell, South Carolina, as described in Sect. 4.3.5. Projections were made only through 2005 because of large uncertainties in commercial disposal facility operations.

Table 4.4. Historical annual additions and total volume of LLW disposed at DOE sites[a,b]

End of year[c]	Volume of waste disposed annually, 10^3 m_3										
	FEMP	Hanford	INEEL	LANL	NTS	ORNL	SRS	Y-12[d]	All others[e]	Total annual addition	Total rounded off volume
1975[f]	309.3	352.0	84.6	131.6	8.3	181.5	269.1	58.4	83.9	1,478.9	1,479
1976	14.4	4.1	6.2	8.8	0.0	3.8	8.1	2.7	0.9	49.0	1,528
1977	2.8	10.7	6.6	3.6	0.5	2.4	14.7	1.5	1.1	43.9	1,572
1978	1.9	9.8	5.9	7.5	10.0	2.0	15.5	1.4	3.2	57.2	1,629
1979	1.6	17.5	5.3	4.9	15.8	2.1	18.2	1.1	1.1	67.6	1,697
1980	1.3	10.4	5.1	4.8	13.3	2.0	19.6	1.4	0.7	58.6	1,755
1981	1.5	12.8	3.1	5.5	21.1	1.4	20.1	1.2	1.6	68.3	1,824
1982	2.8	11.7	3.2	4.5	57.0	1.3	22.4	2.2	2.0	107.1	1,931
1983	3.4	17.9	5.5	3.2	12.1	1.8	26.7	3.4	1.7	75.7	2,006
1984	3.5	18.8	3.9	5.4	36.0	2.2	26.1	7.2	10.6	113.7	2,120
1985	0.7	17.0	3.1	6.7	41.7	2.2	30.5	18.7	2.1	122.7	2,243
1986	0.0	21.1	3.4	4.5	27.9	1.8	30.1	15.0	1.0	104.8	2,348
1987	0.0	20.3	3.0	3.7	81.1	0.5	28.2	16.2	1.0	154.0	2,501
1988	0.0	16.8	2.0	4.3	39.1	0.6	30.2	10.6	1.0	104.6	2,606
1989	0.0	13.7	1.3	6.4	35.0	1.3	26.8	5.7	2.3	92.5	2,699
1990	0.0	13.4	1.8	4.5	9.1	0.3	26.6	4.4	0.0	60.1	2,759
1991	0.0	10.6	1.3	5.8	11.6	0.2	23.8	0.3	0.0	53.6	2,812
1992	0.0	10.9	0.8	2.3	20.1	1.1	13.0	0.0	0.0	48.2	2,860
1993	0.0	12.1	0.9	2.7	18.6	0.8	15.3	0.1	0.0	50.5	2,911
1994	0.0	13.7	1.9	1.9	22.9	0.3	11.4	0.0	0.0	52.1	2,963
1995	0.0	14.9	0.9	1.6	20.0	0.4	10.6	0.0	0.0	48.5	3,011
1996	0.0	9.7	0.3	4.0	12.7	0.4	6.5	0.0	0.0	33.7	3,045
Total	343.2	639.9	150.2	228.2	514.1	210.4	693.5[g]	151.3	114.2	3,045	

[a]No TRUW included; data from refs. 1 and 5. Slight differences in values shown and those actually reported result from round-off and truncation of numbers. Certain of the burial grounds in which these wastes were previously disposed of are being addressed in the Environmental Restoration (EM-40) program.

[b]See Table 4.11 for breakdown of disposed volumes by matrix parameter category (MPC) code.

[c]Data for years 1975–1995 are given on a CY basis. Data for 1996 represent FY data.

[d]Land disposal of LLW at Y-12 was terminated July 1, 1991. A single exception was made in 1993 when waste was placed in the Bear Creek Burial Ground walk-in pits.

[e]Includes contributions from Ames, BNL, ETTP, LLNL, PAD, PANT, PORTS, and SNL/NM.

[f]Values for 1975 are cumulative volumes to this date (ref. 3).

[g]Excludes contributions of LLW from final HLW form production.

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
		Liquids	
L0000	Liquids	NA	Liquids and slurries that cannot be categorized as aqueous liquids/slurries or organic liquids because it is not known if the total organic carbon (TOC) level is less or greater than 1%
L1000	Aqueous liquids/slurries	NA	Liquids and slurries containing less than 1% TOC
L1100	Wastewaters	NA	Aqueous liquids and slurries that meet the U.S. Environmental Protection Agency (EPA) Land Disposal Restriction (LDR) criteria for wastewaters [<1% total suspended/settled solids (TSS) content]
L1110	Acidic wastewaters	NA	Wastewaters with a pH $\leq$ 2.0
L1120	Basic wastewaters	NA	Wastewaters with a pH $\geq$ 12.5
L1130	Neutral wastewaters	NA	Wastewaters with 2.0 < pH < 12.5
L1200	Aqueous slurries	NA	Aqueous liquids and slurries for which either (a) it is known that the TSS $\geq$1%, or (b) it is unknown if the TSS $\geq$1%
L2000	Organic liquids	NA	Liquids and slurries containing $\geq$1% TOC
L2000a	Organic liquids—oils	NA	Waste meeting the definition of L2000 for which the organic component is oil
L2120	Aqueous non-halogenated organic compound (HOC) organic liquids	NA	Aqueous and organic liquids that contain less than 1000 ppm HOC
L2220	Non-HOC pure organic liquids	NA	Pure organic liquids that contain less than 1000 ppm HOC
		Solids	
S0000	Solids	Solids	Wastes with physically solid matrices for which insufficient characterization information exists to enable categorizing as a homogeneous solid, soil/gravel, or debris

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
		Solids (continued)	
S3000	Homogeneous solids	Unknown/other homogeneous solids	Wastes that are at least 50 vol % homogeneous solids, but: • are insufficiently characterized to enable categorization as either inorganic or organic homogeneous solids, or • do not meet the criteria for categorization as either inorganic or organic homogeneous solids
S3100	Inorganic homogeneous solids	Other inorganic particulates	Wastes that are at least 50 vol % inorganic homogeneous solids. Homogeneous solids are defined as solid waste materials, excluding soil/gravel, that do not meet the EPA LDR criteria for classification as debris. Inorganic homogeneous solids are further defined as those with sufficient inorganic solids content such that a minimum of approximately 20 wt % would remain as residue (i.e., ash/solids) following incineration
S3111	Ash	Incinerator ash	Waste that is primarily (i.e., ≥50 vol %) bottom or fly ash resulting from incineration
S3113	Inorganic particulate absorbents	NA	Waste that is primarily (i.e., ≥50 vol %) inorganic particulate absorbent materials, including absorbed aqueous liquids, if present. Examples include clay, vermiculite, and diatomaceous earth
S3114	Absorbed organic liquids	NA	Waste that is primarily (i.e., >50 vol %) inorganic particulate absorbent materials with absorbed organic liquids
S3118	Activated carbon	Activated carbon (charcoal)	Waste that is primarily (i.e., ≥50 vol %) spent or unused activated carbon, including any residual liquids. The activated carbon may be in powdered (typically 50 to 100 µm) or granular (typically 0.1 to 1 mm) form
S3121	Wastewater treatment sludges	NA	Waste that is at least 50 vol % secondary sludge, filter cake from wastewater treatment processes, or heavy metal sludges resulting from recovery processes, excluding HLW
S3130	Paint waste	Paint waste	Waste that is at least 50 vol % new, used, or removed paint. This includes such paint waste packaged in a lab pack configuration
S3140	Salt waste	Salt waste	Waste that is at least 50 vol % salts, including interstitial liquids, if present

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
		Solids (continued)	
S3150	Solidified homogeneous solids	Solidified sludge/resin	Waste that is at least 50 vol % solidified forms that require further treatment before disposal. The original, unsolidified waste may be either inorganic or organic, while the solidification agent must be inorganic. An example might be a particulate or sludge waste that has been immobilized with cement and cured into a solidified form, but that does not meet LDR treatment standards, if applicable, or other relevant disposal criteria
S3152a	Solidified homogeneous solids (chelates/oils)	Solidified liquids/chelates/oils	Waste meeting the definition of solidified homogeneous solids (S3150) for which the solidified wastes are either chelates or oils
S3200	Organic homogeneous solids	NA	Wastes that are at least 50 vol % organic homogeneous solids. Homogeneous solids are defined as solid waste materials, excluding soil/gravel, that do not meet the EPA LDR criteria for classification as debris. Organic homogeneous solids are further defined as those with a base structure that is primarily organic such that a maximum of approximately 20 wt % would remain as residue (i.e., ash/solids) following incineration
S3212	Organic absorbents	NA	Waste that is primarily (i.e., $\geq$50 vol %) organic particulate absorbent materials, including any absorbed aqueous or organic liquids. Examples include sawdust and ground corncobs
S4000	Soil/gravel	Soil/sediment/rubble	Waste estimated to be 50 vol % soil, including sand and silt, or rock and gravel that does not meet the U.S. Environmental Protection Agency (EPA) LDR criteria for classification as debris
S4100	Soil	Soil/sediment/rubble	Waste estimated to be $\geq$95 vol % soil, including sand, silt, and rock and gravel, with rock and gravel volumes <50 vol % of the matrix
S5000	Debris waste	Debris waste	Wastes that are at least 50 vol % materials that meet the EPA LDR criteria for classification as debris but lack adequate characterization information to enable categorizing as inorganic, organic, or heterogeneous debris
S5000a	Debris compactible	Debris—noncombustible and compactible	Wastes meeting criteria of S5000 that are at least 50 wt % compactible materials
S5000b	Debris—combustible and noncombustible	Debris—combustible and noncombustible (mixed)	Wastes meeting criteria of S5000 that are at least 50 wt % noncombustible materials

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
		Solids (continued)	
S5100	Inorganic debris	NA	Wastes that are at least 80 vol % inorganic materials that meet the EPA LDR criteria for classification as debris. Examples include scrap metal, concrete, glass, and brick
S5111	Nonactivated metal debris	Contaminated metal/ equipment/hardware	Waste estimated to be 80 vol %, or more, metal debris that is not activated (i.e., radioactivity is due to surface contamination)
S5111a	Metal debris—reactor components	Reactor components/ compartments	Waste meeting the definition of S5111 for which metal is reactor components
S5112	Activated metal debris	Activated metal/equipment/ hardware	Waste estimated to be 80 vol %, or more, activated metal debris
S5120	Inorganic nonmetal debris	NA	Wastes that are at least 80 vol % inorganic nonmetal debris
S5122	Glass debris	NA	Wastes that are at least 80 vol % glass debris
S5125	Asbestos debris	Asbestos-contaminated waste	Waste estimated to be 80 vol %, or more, asbestos or asbestos-based debris materials. Examples of waste that might be included in this category are asbestos-containing gloves, fire hoses, aprons, flooring tiles, pipe insulation, boiler jackets, and laboratory tabletops
S5300	Organic debris	Debris—combustible	Waste estimated to be 80 vol %, or more, organic debris materials. Examples of organic debris are materials constructed of plastic, rubber, wood, paper, cloth, and biological materials
S5310	Plastic/rubber debris	NA	Wastes that are at least 80 vol % plastic or rubber debris materials. Examples include plastic or rubber sheeting, containers, gloves, gaskets, and components of benelex or plexiglass
S5330	Paper/cloth debris	NA	Wastes that are at least 80 vol % paper or cloth debris materials. Examples include protective clothing, rags, or wipes
S5340	Biological debris	Biological waste and carcasses	Waste estimated to be 80 vol %, or more, biological debris materials, including any chemical agents such as lime or formaldehyde. Examples of waste that might be included in this category are biological samples and animal carcasses

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
		Solids (continued)	
S5400	Heterogeneous debris	NA	Wastes that are at least 50 vol % debris materials that meet the EPA LDR criteria for classification as debris but are not dominant (i.e., at least 80 vol %) in either inorganic or organic debris materials
S5410	Composite filter debris	Filter media	Debris estimated to be 50 vol %, or more, high-efficiency particulate air (HEPA) filters or other filters constructed of more than one material type (e.g., metal, inorganic nonmetal, and organic materials). Filters constructed of a single material type are assigned into the appropriate inorganic, organic, or heterogeneous debris category depending on the composition of the entire waste matrix
		Specific waste forms	
X6000	Lab packs	Other	A lab-pack configuration is defined as two or more waste containers packaged within a larger outer container. Typically, the inner containers are surrounded by absorbent materials; however, this is not an absolute criterion. If present, the absorbents can be homogeneous solids or debris materials. Examples may include rags, vermiculite, diatomaceous earth, and paper wipes. This summary category includes waste that either (a) is packaged as a lab pack upon generation or (b) will be packaged as a lab pack before transfer to long-term storage or treatment. This category does not include lab packs of elemental liquid mercury or paint waste. In addition, waste packaged in a lab-pack configuration that is considered overpacked is excluded. A typical example of an overpack is a single 55-gal drum of waste that is placed in an 85-gal drum because of deterioration of the 55-gal container. This waste should be assigned the appropriate category based on the waste within the inner, overpacked container(s)
X7210	Elemental lead—shielding	Elemental lead shielding	Waste that contains at least 50 vol % bulk elemental lead. Examples of waste in this category are lead bricks, sheets, and pipes

Specific waste forms (continued)

Table 4.5 (continued)

MPC code	Name	IDB Rev. 12 category[b]	Description
X7800	Sealed sources	Sources	Includes waste consisting of encapsulated radioactive material whose main purpose is to generate known amounts of radiation. Sealed sources are defined in 10 CFR Part 71.4 as a category of special-form radioactive material. Special-form radioactive material means radioactive material which satisfies the following conditions: 1. It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule; 2. The piece or capsule has at least one dimension not less than 5 mm; and 3. It satisfies the test requirements of 10 CFR Part 71.75
U9999	Unknown/other matrix	Other	Wastes for which insufficient characterization information is known to enable categorization as a liquid or solid or as one of the specific waste forms

[a]Sources: T. D. Kirkpatrick, *DOE Waste Treatability Group Guidance*, DOE/LL-W-217, Revision 0, Idaho National Engineering Laboratory, Lockheed Idaho Technologies Company, Idaho Falls, Idaho, January 1995; Mark W. Frei, "Collection of Waste Management Technical Information," U.S. Department of Energy, EM-35, Washington, D.C., Apr. 11, 1997.

[b]If applicable. In this column, NA means not applicable.

Table 4.6. Actual FY 1996 generation and projected generation of LLW at DOE sites[a]

Waste description	MPC code	Fiscal-year LLW volume (m^3) generation			
		Actual	Projected total generation		
		1996	1997	1998–2006	2007–2030
Liquids	L0000	227	237	576	1,171
Wastewaters	L1100	76	86	672	1,470
Acidic wastewaters	L1110	0	0	0	0
Neutral wastewaters	L1130	6	15	16	10
Aqueous slurries	L1200	6	1	54	7
Organic liquids	L2000	15	12	113	265
Organic liquids–oils	L2000a	10	6	9	21
Aqueous non-HOC[b] organic liquids	L2120	2	1	4	3
Non-HOC pure organic liquids	L2220	12	17	36	23
Solids	S0000	5,714	8,569	48,577	215,149
Homogeneous solids	S3000	0	1	7	19
Inorganic homogeneous solids	S3100	34	176	7,711	657
Ash	S3111	5	5	23	32
Inorganic particulate absorbents	S3113	23	12	47	30
Absorbed organic liquids	S3114	0	1	7	20
Activated carbon	S3118	6	1	18	18
Wastewater treatment sludges	S3121	157	159	1,883	2,200
Paint waste	S3130	0	0	2	0
Salt waste	S3140	0	0	0	0
Solidified homogenous solids	S3150	585	535	21,890	2,062
Solidified homogeneous solids—chelates/oils	S3152a	9	6	51	120
Organic homogeneous solids	S3200	0	0	4	11
Organic absorbents	S3212	6	7	101	271
Soil/gravel	S4000	3,818	8,994	27,916	3,678
Soil	S4100	942	1,134	15,904	29,377
Debris waste	S5000	119	119	167	257
Debris compactible	S5000a	468	227	1,303	2,576
Debris—combustible and noncombustible	S5000b	8,535	9,874	65,581	133,518
Inorganic debris	S5100	28	31	467	1,017
Nonactivated metal debris	S5111	915	1,998	18,598	24,104
Nonactivated metal debris—reactor component	S5111a	90	131	1,486	1,274
Activated metal debris	S5112	119	182	294	397
Inorganic nonmetal debris	S5120	0	6	0	0
Glass debris	S5122	2	3	36	97
Asbestos debris	S5125	241	266	2,293	4,069
Organic debris	S5300	3,144	2,310	26,842	33,230
Plastic/rubber debris	S5310	3	4	56	150
Paper/cloth debris	S5330	169	215	3,018	7,132
Biological debris	S5340	1	6	28	67
Heterogeneous debris	S5400	2,067	2,101	32,112	50,293
Composite filters	S5410	36	245	8,106	1,817
Unknown/other matrix	U9999	15	278	959	0
Lab packs	X6000	0	0	0	0
Sealed sources	X7800	2	0	1	1
Total (without ORR[c] contributions)		27,605	37,965	286,970	516,613
Total ORR		3,159	2,477	22,293	58,449
Grand total		30,764	40,452	309,263	575,062

[a]Based on ref. 1.
[b]HOC = halogenated organic compound.
[c]ORR = Oak Ridge Reservation.

Table 4.7. Actual FY 1996 disposal and projected disposal of LLW at DOE sites[a]

Waste description	MPC code	Fiscal-year LLW volume (m^3) disposed			
		Actual	Projected		
		1996	1997	1998–2006	2007–2030
Liquids	L0000	9	84	432	1,020
Neutral wastewaters	L1130	0	16	16	10
Aqueous slurries	L1200	0	0	0	16
Aqueous/nonhalogenated organic liquids	L2120	0	1	4	3
Non-HOC pure organic liquids	L2220	0	17	36	23
Solids	S0000	5,576	8,646	43,891	171,407
Homogeneous solids	S3000	0	1	7	19
Inorganic homogeneous solids	S3100	648	179	7,618	777
Ash	S3111	b	5	22	27
Inorganic particulate absorbents	S3113	0	12	47	30
Absorbed organic liquids	S3114	0	1	7	20
Wastewater treatment sludges	S3121	71	183	1,884	2,200
Salt waste	S3140	0	0	1	0
Solidified homogenous solids	S3150	187	453	15,629	2,466
Organic homogeneous solids	S3200	0	0	4	11
Organic absorbents	S3212	6	7	101	271
Soil/gravel	S4000	604	7,319	9,758	3,318
Soil	S4100	926	1,134	15,904	29,377
Debris waste	S5000	0	113	113	113
Debris compactible	S5000a	991	123	543	1,097
Debris—combustible and noncombustible	S5000b	6,064	9,168	34,733	54,360
Inorganic debris	S5100	25	31	467	1,017
Nonactivated metal debris	S5111	461	1,321	17,147	21,275
Nonactivated metal debris—reactor component	S5111a	4,150	0	355	0
Activated metal debris	S5112	3	162	242	381
Inorganic nonmetal debris	S5120	0	6	0	0
Glass debris	S5122	2	3	36	97
Asbestos debris	S5125	115	154	1,942	3,886
Organic debris	S5300	332	770	18,745	16,388
Plastic/rubber debris	S5310	3	4	56	150
Paper/cloth debris	S5330	169	215	3,018	7,132
Biological debris	S5340	b	7	29	67
Heterogeneous debris	S5400	2,041	2,101	32,112	50,293
Composite filters	S5410	16	180	7,796	1,689
Sealed sources	X7800	0	1	0	6
Unknown/other matrix	U9999	11,273	614	19,823	47,690
Total		33,672	33,031	232,518	416,637

[a]Based on ref. 1.
[b]Information unknown.

Table 4.8. Actual and projected volumes (m^3) of LLW generated, by site[a]

Site	Actual FY 1996	FY projections		
		1997	1998–2006	2007–2030
Ames	2	0	0	0
ANL–E	211	255	255	255
ANL–W	270	532	3,359	6,433
BNL	416	477	466	466
ETEC	925	3,990	15,500	0
FNAL	30	0	0	0
Hanford	3,922	6,711	40,272	201,234
INEEL	6,791	3,783	18,638	44,289
LANL	4,022	4,296	66,882	120,000
LBNL	23	23	206	681
LEHR	308	410	7,205	0
LLNL	279	205	1,611	3,412
Mound	749	595	9,144	0
Naval laboratories[b]				
BAPL	439	891	3,380	2,646
KAPL	96	96	859	2,376
KESS	113	115	1,069	990
KWIN	141	112	121	0
NTS	6	1	30	0
ORR[c]	3,159	2,477	22,293	58,449
PANT	174	437	809	340
PPPL	34	71	147	672
RFETS	0	1,170	57,548	2,558
SNL/CA	1	0	7	4
SRS	8,195	13,534	57,757	130,258
TTR[d]	15	0	0	0
WVDP	444	272	1,705	0
Total	30,764	40,452	309,263	575,062

[a]Based on ref. 1.

[b]DOE Office of Naval Reactors (NE-60) sites. Naval laboratory contributions include Bettis Atomic Power Laboratory (BAPL), Knolls Atomic Power Laboratory (KAPL)–Schenectady, Knolls Kesselring Site (KESS), and Knolls Windsor Site (KWIN).

[c]Oak Ridge Reservation. Includes contributions from three Oak Ridge sites: ETTP, ORNL, and Y-12.

[d]Tonopah Test Range, Nellis Air Force Base, Nevada.

Table 4.9. Breakdown by waste description of volumes of LLW generated during FY 1996 at DOE sites[a]

MPC name	MPC code	Total	Breakdown of MPC total generated volume, by site					
			Ames	ANL–E	ANL–W	BAPL	BNL	ETEC
Liquids	L0000	227					210	
Wastewaters	L1100	76						
Acidic wastewaters	L1110	0						
Neutral wastewaters	L1130	6						
Aqueous slurries	L1200	6						
Organic liquids	L2000	15					0	
Organic liquids—oils	L2000a	10					2	0
Aqueous non-HOC[b] organic liquids	L2120	2						
Non-HOC pure organic liquids	L2220	12						
Solids	S0000	5,714		211				
Homogeneous solids	S3000	0						
Inorganic homogeneous solids	S3100	34						
Ash	S3111	5						
Inorganic particulate absorbents	S3113	23						
Absorbed organic liquids	S3114	0						
Activated carbon	S3118	6						
Wastewater treatment sludges	S3121	157						
Paint waste	S3130	0						
Salt waste	S3140	0						0
Solidified homogenous solids	S3150	585				34		
Solidified homogeneous solids—chelates/oils	S3152a	9						
Organic homogeneous solids	S3200	0						
Organic absorbents	S3212	6						
Soil/gravel	S4000	3,818				0		434
Soil	S4100	942						
Debris waste	S5000	119	2		33		84	
Debris compactible	S5000a	468			46		32	
Debris—combustible and noncombustible	S5000b	8,535				212		482
Inorganic debris	S5100	28						
Nonactivated metal debris	S5111	915			99	26		
Nonactivated metal debris—reactor components	S5111a	90				90		
Activated metal debris	S5112	119			0		86	
Inorganic nonmetal debris	S5120	0						
Glass debris	S5122	2						
Asbestos debris	S5125	241				77	1	8
Organic debris	S5300	3,144			92			
Plastic/rubber debris	S5310	3						
Paper/cloth debris	S5330	169						
Biological debris	S5340	1						
Heterogeneous debris	S5400	2,067						
Composite filters	S5410	36						
Unknown/other matrix	U9999	15			0		0	
Lab packs	X6000	0						
Sealed sources	X7800	2						2
Total (without ORR[c])		27,607	2	211	270	439	415	926

(Continued on next page.)

Table 4.9 (continued)

MPC name	MPC code	Total	Breakdown of MPC total generated volume, by site					
			FNAL	Hanford	INEEL	KAPL	KESS	KWIN
Liquids	L0000	227		7	9			
Wastewaters	L1100	76						
Acidic wastewaters	L1110	0						
Neutral wastewaters	L1130	6						
Aqueous slurries	L1200	6						
Organic liquids	L2000	15						
Organic liquids—oils	L2000a	10			0			
Aqueous non-HOC organic liquids	L2120	2						
Non-HOC pure organic liquids	L2220	12						
Solids	S0000	5,714		3,752	1,171			
Homogeneous solids	S3000	0						
Inorganic homogeneous solids	S3100	34			12	0		
Ash	S3111	5			0			
Inorganic particulate absorbents	S3113	23						
Absorbed organic liquids	S3114	0						
Activated carbon	S3118	6			4	0	1	
Wastewater treatment sludges	S3121	157						
Paint waste	S3130	0						
Salt waste	S3140	0						
Solidified homogenous solids	S3150	585		164	24	8	4	
Solidified homogeneous solids—chelates/oils	S3152a	9				2	3	
Organic homogeneous solids	S3200	0						
Organic absorbents	S3212	6						
Soil/gravel	S4000	3,818			2,708	3	0	
Soil	S4100	942						
Debris waste	S5000	119						
Debris compactible	S5000a	468			0	3		
Debris—combustible and noncombustible	S5000b	8,535				24	98	3
Inorganic debris	S5100	28						
Nonactivated metal debris	S5111	915			231	44	0	108
Nonactivated metal debris—reactor components	S5111a	90						
Activated metal debris	S5112	119	30		3			0
Inorganic nonmetal debris	S5120	0						
Glass debris	S5122	2						
Asbestos debris	S5125	241			1	8	6	24
Organic debris	S5300	3,144			2,616	2		
Plastic/rubber debris	S5310	3						
Paper/cloth debris	S5330	169						
Biological debris	S5340	1			0			
Heterogeneous debris	S5400	2,067						
Composite filters	S5410	36			11	1		5
Unknown/other matrix	U9999	15						
Lab packs	X6000	0						
Sealed sources	X7800	2			0		0	0
Total (without ORR[C])		27,607	30	3,923	6,791	96	113	141

(Continued on next page.)

Table 4.9 (continued)

MPC name	MPC code	Total	Breakdown of MPC total generated volume, by site					
			LANL	LBNL	LEHR	LLNL	Mound	NTS
Liquids	L0000	227		1				
Wastewaters	L1100	76		5		70		
Acidic wastewaters	L1110	0						
Neutral wastewaters	L1130	6						
Aqueous slurries	L1200	6				0		
Organic liquids	L2000	15		4		11		
Organic liquids—oils	L2000a	10				5		
Aqueous non-HOC organic liquids	L2120	2						
Non-HOC pure organic liquids	L2220	12						
Solids	S0000	5,714					560	
Homogeneous solids	S3000	0	0					
Inorganic homogeneous solids	S3100	34		3		3		
Ash	S3111	5						
Inorganic particulate absorbents	S3113	23						
Absorbed organic liquids	S3114	0	0					
Activated carbon	S3118	6						
Wastewater treatment sludges	S3121	157	63		0		94	
Paint waste	S3130	0						
Salt waste	S3140	0				0		
Solidified homogenous solids	S3150	585				89	95	
Solidified homogeneous solids—chelates/oils	S3152a	9						
Organic homogeneous solids	S3200	0	0					
Organic absorbents	S3212	6	6					
Soil/gravel	S4000	3,818		0	18	9		
Soil	S4100	942	925					
Debris waste	S5000	119		0				
Debris compactible	S5000a	468		0	291	59		6
Debris—combustible and noncombustible	S5000b	8,535				9		
Inorganic debris	S5100	28	25					
Nonactivated metal debris	S5111	915	340	4	0	18		
Nonactivated metal debris—reactor components	S5111a	90						
Activated metal debris	S5112	119						
Inorganic nonmetal debris	S5120	0						
Glass debris	S5122	2	2					
Asbestos debris	S5125	241	114	0		0		
Organic debris	S5300	3,144	317	4		7		
Plastic/rubber debris	S5310	3	3					
Paper/cloth debris	S5330	169	169					
Biological debris	S5340	1			0	0		
Heterogeneous debris	S5400	2,067	2,041					
Composite filters	S5410	36	16			0		
Unknown/other matrix	U9999	15						
Lab packs	X6000	0						
Sealed sources	X7800	2			0	0		
Total (without ORR[c])		27,607	4,022	21	308	280	749	6

(Continued on next page.)

Table 4.9 (continued)

MPC name	MPC code	Total	Breakdown of MPC total generated volume, by site					
			PPPL	PANT	SNL/CA	SRS	TTR	WVDP
Liquids	L0000	227						
Wastewaters	L1100	76						
Acidic wastewaters	L1110	0		0				
Neutral wastewaters	L1130	6		6				
Aqueous slurries	L1200	6						6
Organic liquids	L2000	15						
Organic liquids—oils	L2000a	10						3
Aqueous non-HOC organic liquids	L2120	2		2				
Non-HOC pure organic liquids	L2220	12		12				
Solids	S0000	5,714	20		1			
Homogeneous solids	S3000	0						
Inorganic homogeneous solids	S3100	34						16
Ash	S3111	5		5				0
Inorganic particulate absorbents	S3113	23		23				
Absorbed organic liquids	S3114	0						
Activated carbon	S3118	6						0
Wastewater treatment sludges	S3121	157						
Paint waste	S3130	0						0
Salt waste	S3140	0						
Solidified homogenous solids	S3150	585	14					154
Solidified homogeneous solids—chelates/oils	S3152a	9						3
Organic homogeneous solids	S3200	0						
Organic absorbents	S3212	6						
Soil/gravel	S4000	3,818		0		519	15	112
Soil	S4100	942		16				
Debris waste	S5000	119						
Debris compactible	S5000a	468						31
Debris—combustible and noncombustible	S5000b	8,535				7,676		32
Inorganic debris	S5100	28		3				
Nonactivated metal debris	S5111	915		7				37
Nonactivated metal debris—reactor components	S5111a	90						
Activated metal debris	S5112	119						
Inorganic nonmetal debris	S5120	0		0				
Glass debris	S5122	2						
Asbestos debris	S5125	241						3
Organic debris	S5300	3,144		75				30
Plastic/rubber debris	S5310	3						
Paper/cloth debris	S5330	169						
Biological debris	S5340	1						0
Heterogeneous debris	S5400	2,067		27				
Composite filters	S5410	36						4
Unknown/other matrix	U9999	15						15
Lab packs	X6000	0		0				
Sealed sources	X7800	2						
Total (without ORR[c])		27,607	34	174	1	8,195	15	444

[a]Based on ref. 1.
[b]HOC = halogenated organic compound.
[c]ORR = Oak Ridge Reservation, which generated an additional 3,157 m^3.

Table 4.10. Cumulative volumes of contaminated media in storage at DOE sites classified as LLW[a]

Site	Volume, m^3
FEMP	140,000
FUSRAP[b]	27,000
GA[c]	350
GJPO Site	6
PAD	110,000
PORTS	13,000
RMI	640
Total	290,000[d]

[a]Based on Table 6.8 in Chapter 6. Volumes are given to two significant figures or the nearest integer (for volumes less than 10 m^3).

[b]FUSRAP = Formerly Utilized Sites Remedial Action Program. The reported volume represents soil in bulk storage at the Middlesex Sampling Plant. This program was recently transferred to the U.S. Army Corps of Engineers.

[c]General Atomics Site.

[d]Rounded to two significant figures.

Table 4.11. Breakdown by waste description of volumes of LLW disposed during FY 1996 at DOE sites[a]

Waste description	MPC code	Volume, m^3						
		Hanford	INEEL	LANL	NTS	ORNL	SRS	Total
Liquids	L0000		9					9
Solids	S0000	5,400	119		57			5,576
Homogeneous solids	S3000							0
Inorganic homogeneous solids	S3100		12		636			648
Ash	S3111							b
Absorbed organic liquids	S3114							0
Wastewater treatment sludges	S3121			63	8			71
Solidified homogenous solids	S3150	164	23					187
Organic homogeneous solids	S3200							0
Organic absorbents	S3212			6				6
Soil/gravel	S4000		32		127		445	604
Soil	S4100			926				926
Debris compactible	S5000a				991			991
Debris—combustible and noncombustible	S5000b						6,064	6,064
Inorganic debris	S5100			25				25
Nonactivated metal debris	S5111		121	340				461
Nonactivated metal debris—reactor components	S5111a	4,150						4,150
Activated metal debris	S5112		3					3
Glass debris	S5122			2				2
Asbestos debris	S5125		1	114				115
Organic debris	S5300		15	317				332
Plastic/rubber debris	S5310			3				3
Paper/cloth debris	S5330			169				169
Biological debris	S5340							b
Heterogeneous debris	S5400			2,041				2,041
Composite filters	S5410			16				16
Unknown/other matrix	U9999				10,904	369		11,273
Total		9,714	335	4,022	12,723	369	6,509	33,672

[a]Based on ref. 1.
[b]Information unknown.

Table 4.12. DOE LLW disposed by methods other than shallow-land burial[a]

Site	Location	Site use (year)	Waste containers buried[b]	Undecayed radioactive content (Ci)
		Atlantic Ocean		
Atlantic	38°30′N 72°06′W	1951–1956; 1959–1962	14,300	74,400[c]
Atlantic	37°50′N 70°35′W	1957–1959	14,500	2,100
Massachusetts Bay	42°25′N 70°35′W	1952–1959	4,008	2,440
Cape Henry	36°56′N 74°23′W	1949–1967	843	87
Central Atlantic	36°20′N/ 43°49′N 45°00′W	1959–1960	432	480
Subtotal			34,083	79,507
		Pacific Ocean		
Farallon Islands (Subsite A)	37°38′N 123°08′W	1951–1953	3,500	1,100
Farallon Islands (Subsite B)	37°37′N 123°17′W	1946–1950; 1954–1956	44,000	13,400
Santa Cruz Basin	33°40′N 119°40′W	1946–1962	3,114	108
Cape Scot	50°56′N 136°03′W 52°25′N 140°12′W	1958–1969	360	124
San Diego	32°00′N 121°30′W	1959–1962	4,415	34
Subtotal			55,389	14,766
Total (oceans)			89,472	94,273
		Hydrofracture facility		
ORNL	Bedded Conasauga shale underlying the ORNL site	1959–1965	Small experimental amounts of grout	
		1966–1980[d]	8.0×10^3 m^3	600,000
		1982[e]	3.8×10^3 m^3	200,000
		1983[e]	5.5×10^3 m^3	
Total			17.3 × 10^3 m^3	

[a]Radioactivity is given at time of disposal. Data taken from Table 4.5 of ref. 3.
[b]Estimated number of containers.
[c]Includes approximately 33,000 Ci of induced activity associated with the *U.S.S. Seawolf* reactor vessel.
[d]Retired after 18 injections.
[e]New facility started up with four injections in 1982 and completed campaign with seven injections in 1983.

Table 4.13. Historical and projected volume, radioactivity, and thermal power characteristics of disposed DOE LLW, except LLW from HLW vitrification

End of year[a]	Volume[b,c] (10^3 m^3)		Radioactivity[b,c] (10^3 Ci)		Thermal power (W)	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1990	60.0	2,759	545	13,516	2,013	17,844
1991	53.6	2,812	717	13,277	2,788	18,220
1992	48.3	2,860	1,078	13,401	4,947	20,741
1993	50.5	2,911	894	13,147	3,263	20,398
1994	52.1	2,963	621	12,858	3,463	21,534
1995	48.5	3,011	422	12,550	2,378	22,195
1996	33.7	3,045	245	12,148	1,331	22,022
1997	33.0	3,078	463	12,023	2,521	23,171
1998	25.8	3,104	365	11,811	2,087	23,767
1999	25.8	3,130	365	11,611	2,087	24,285
2000	25.8	3,156	365	11,421	2,087	24,727
2001	25.8	3,182	365	11,240	2,087	25,096
2002	25.8	3,207	365	11,068	2,087	25,399
2003	25.8	3,233	365	10,904	2,087	25,642
2004	25.8	3,259	365	10,747	2,087	25,833
2005	25.8	3,285	365	10,599	2,087	25,978
2006	25.8	3,311	365	10,459	2,087	26,082
2007	17.4	3,329	247	10,209	1,360	25,425
2008	17.4	3,346	247	9,986	1,360	24,847
2009	17.4	3,364	247	9,783	1,360	24,320
2010	17.4	3,381	247	9,598	1,360	23,839
2011	17.4	3,398	247	9,429	1,360	23,397
2012	17.4	3,416	247	9,273	1,360	22,990
2013	17.4	3,433	247	9,129	1,360	22,613
2014	17.4	3,451	247	8,996	1,360	22,265
2015	17.4	3,468	247	8,873	1,360	21,940
2016	17.4	3,485	247	8,760	1,360	21,638
2017	17.4	3,503	247	8,654	1,360	21,356
2018	17.4	3,520	247	8,556	1,360	21,090
2019	17.4	3,537	247	8,465	1,360	20,841
2020	17.4	3,555	247	8,381	1,360	20,607
2021	17.4	3,572	247	8,303	1,360	20,385
2022	17.4	3,589	247	8,231	1,360	20,175
2023	17.4	3,607	247	8,164	1,360	19,975
2024	17.4	3,624	247	8,102	1,360	19,786
2025	17.4	3,642	247	8,044	1,360	19,605
2026	17.4	3,659	247	7,992	1,360	19,432
2027	17.4	3,676	247	7,943	1,360	19,267
2028	17.4	3,694	247	7,898	1,360	19,109
2029	17.4	3,711	247	7,857	1,360	18,957
2030	17.4	3,728	247	7,820	1,360	18,811

[a]Historical data prior to 1996 are expressed on an EOCY basis.

[b]Historical (beginning of operations through 1995) annual values of volume and radioactivity for each site are from ref. 5. Similar values for 1996 are from ref. 1. See Tables 4.4, 4.7, and 4.11 for more detail. For disposals prior to 1994, radioactivity (by waste type) is decayed from the year of addition using the representative compositions given in Table A.2 of Appendix A. Starting with 1994, representative compositions provided by the sites in the data call for Rev. 11 of this report are used to decay radioactivity.

[c]Beginning in 1997, projected disposals are estimated for each active disposal site. Estimated values reported in this table may not agree with summary data reported in Table 4.7 because projections were reported as either unknown or unavailable by some sites.

Table 4.14. Projected volume, radioactivity, and thermal power characteristics of DOE LLW from final HLW form production at Hanford[a]

End of year	Volume[b] (10^3 m^3)		Radioactivity[c] (10^3 Ci)		Thermal power[c] (W)	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1996–2001	0.0	0.0	0	0	0	0
2002	3.1	3.1	197	197	554	554
2003	3.1	6.2	193	385	541	1,082
2004	3.1	9.3	188	565	528	1,585
2005	3.1	12.4	184	736	516	2,065
2006	3.1	15.4	180	898	504	2,522
2007	3.1	18.5	176	1,053	493	2,957
2008	3.1	21.6	172	1,200	482	3,371
2009	3.1	24.7	168	1,340	471	3,764
2010	3.1	27.8	164	1,473	460	4,137
2011	3.1	30.8	160	1,599	449	4,491
2012	14.3	45.2	725	2,287	2,036	6,424
2013	21.7	67.0	1,075	3,310	3,018	9,295
2014	21.7	88.7	1,050	4,283	2,949	12,030
2015	21.7	110.4	1,026	5,211	2,881	14,640
2016	21.7	132.2	1,003	6,094	2,815	17,120
2017	21.7	153.9	980	6,933	2,751	19,480
2018	21.7	175.7	957	7,731	2,688	21,720
2019	21.7	197.4	935	8,488	2,626	23,850
2020	21.7	219.1	914	9,206	2,566	25,870
2021	21.7	240.9	893	9,888	2,507	27,780
2022	0.0	240.9	0	9,661	0	27,140
2023	0.0	240.9	0	9,439	0	26,520
2024	0.0	240.9	0	9,223	0	25,920
2025	0.0	240.9	0	9,011	0	25,320
2026	0.0	240.9	0	8,804	0	24,750
2027	0.0	240.9	0	8,603	0	24,180
2028	0.0	240.9	0	8,405	0	23,630
2029	0.0	240.9	0	8,213	0	23,090
2030	0.0	240.9	0	8,024	0	22,560

[a]Based on ref. 1([a]) of Chapter 2.

[b]Low-activity waste (LAW) generated from Hanford tank waste disposal operations is to be immobilized in glass. Estimate of volume represents only LLW glass, excluding any possible voids, binders, or encasement materials.

[c]Levels of radionuclides in vitrified LLW are based on data developed to support the report, *Technical Basis for Classification of Low-Activity Waste Fraction from Hanford Site Tanks*, WHC-SD-WM-TI-699, Rev. 1, Westinghouse Hanford Company, Richland, Washington (July 1996).

Table 4.15. Projected volume, radioactivity, and thermal power characteristics of DOE LLW (grout) from HLW vitrification at INEEL[a]

End of FY	Volume (10^3 m^3)		Radioactivity (10^3 Ci)		Thermal power (W)	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1996–2018	0.00	0.00	0	0	0	0
2019	0.25	0.25	0	0	0	0
2020	2.32	2.57	0	0	0	1
2021	1.64	4.21	0	1	0	2
2022	1.64	5.85	0	1	0	3
2023	1.69	7.54	0	1	0	4
2024	1.70	9.24	0	2	0	5
2025	1.71	10.95	0	2	0	5
2026	2.06	13.01	0	2	0	6
2027	2.07	15.08	0	2	0	6
2028	2.40	17.48	0	2	0	6
2029	2.87	20.34	0	2	0	6
2030	2.87	23.21	0	2	0	6
2031	2.71	25.92	0	2	0	6
2032	2.14	28.07	0	2	0	6
2033	2.13	30.20	0	2	0	6
2034	1.82	32.02	0	2	0	6
2035	0.00	32.02	0	2	0	6

[a]Based on ref. 1(b) of Chapter 2.

Table 4.16. Actual and projected volume, radioactivity, and thermal power characteristics of DOE LLW saltstone from HLW glass production at SRS[a]

End of FY	Volume (10^3 m^3)		Radioactivity (10^3 Ci)		Thermal power (W)	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1996[b]	0.5	22.8	0.2	0.2	2.0	2.0
1997	2.0	24.8	8.7	8.9	80.8	82.4
1998	26.9	51.7	8.4	16.4	75.1	147.0
1999	40.3	92.0	8.5	23.9	72.2	202.0
2000	29.9	121.9	8.8	31.8	68.3	246.0
2001	25.8	147.7	9.0	39.9	62.6	277.0
2002	25.3	173.0	9.1	48.3	56.4	298.0
2003	26.1	199.1	9.2	56.7	51.4	317.0
2004	24.6	223.7	9.2	65.0	48.2	342.0
2005	27.0	250.7	9.1	73.3	46.6	373.0
2006	26.0	276.7	9.1	81.4	45.9	412.0
2007	27.2	303.9	9.0	89.5	45.9	455.0
2008	25.9	329.8	8.9	97.3	46.1	502.0
2009	27.4	357.2	8.9	105.0	46.5	551.0
2010	25.2	382.4	8.8	113.0	46.9	602.0
2011	25.4	407.8	8.7	120.0	47.4	654.0
2012	27.0	434.8	8.6	127.0	47.9	707.0
2013	25.0	459.8	8.6	135.0	48.4	760.0
2014	25.2	485.0	8.5	142.0	48.9	815.0
2015	26.4	511.4	8.4	149.0	49.4	870.0
2016	24.1	535.5	8.4	155.0	49.9	927.0
2017	24.9	560.4	8.3	162.0	50.5	984.0
2018	24.4	584.8	8.3	169.0	51.0	1,040.0
2019	0.1	584.8	8.2	175.0	51.5	1,100.0
2020		584.8		173.0		1,110.0
2021		584.8		172.0		1,120.0
2022		584.8		170.0		1,120.0
2023		584.8		169.0		1,130.0
2024		584.8		167.0		1,140.0
2025		584.8		165.0		1,150.0
2026		584.8		164.0		1,150.0
2027		584.8		162.0		1,160.0
2028		584.8		161.0		1,170.0
2029		584.8		160.0		1,180.0
2030		584.8		158.0		1,190.0

[a]Based on ref. 1(c) of Chapter 2.

[b]The cumulative quantities reported for FY 1996 include contributions of LLW generated from prior years. Most of this material is LLW from the processing of concentrate from the SRS Effluent Treatment Facility.

Table 4.17. Historical annual additions and total volume of LLW at commercial disposal sites[a]

Year	Volume, m^3							
	Beatty[b]	West Valley[c]	Maxey Flats[d]	Richland	Sheffield[e]	Barnwell	Annual total	Cumulative total
1962	1,861						1,861	1,861
1963	3,512	127	2,206				5,845	7,706
1964	2,836	5,940	3,872				12,648	20,354
1965	1,988	5,192	5,753	668			13,601	33,955
1966	3,533	3,951	5,557	2,402			15,443	49,398
1967	3,206	7,475	7,820	773	2,527		21,801	71,199
1968	3,576	3,490	8,178	1,359	2,713		19,316	90,515
1969	4,526	4,099	10,354	438	2,012		21,429	111,944
1970	5,152	4,906	12,521	423	2,825		25,827	137,771
1971	4,916	7,002	13,173	584	4,430	1,171	31,276	169,047
1972	4,301	9,045	15,578	654	5,956	3,757	39,291	208,338
1973	4,076	7,535	10,074	1,033	8,524	15,839	47,081	255,419
1974	4,103	8,866	8,898	1,411	12,373	18,244	53,895	309,314
1975	4,943	2,243	17,098	1,500	14,116	18,072	57,972	367,286
1976	3,864	427	13,775	2,867	13,480	40,227	74,640	441,926
1977	4,742	351	423	2,718	17,643	45,663	71,540	513,466
1978	8,874	144		7,422	1,735	61,554	79,729	593,195
1979	6,491	138		12,185		63,861	82,675	675,870
1980	12,717	141		24,819		54,723[f]	92,400	768,270
1981	3,351	216		40,732		39,427[f]	83,726	851,996
1982	1,505	632		39,606		34,779	76,522	928,518
1983	1,111	1,284		40,458		35,132	77,985	1,006,503
1984	2,067	966		38,481		34,879	76,393	1,082,896
1985	1,388	809		40,135		34,389	76,721	1,159,617
1986	2,668	2,095		18,833		29,612	53,208	1,212,825
1987	9,414			15,765		27,060	52,239	1,265,064
1988	2,645			11,430		26,391	40,466	1,305,530
1989	3,291			11,562		31,242	46,095	1,351,625
1990	1,684			8,362		22,315	32,361	1,383,986
1991	4,539			11,872		22,368	38,779	1,422,765
1992	14,575			11,271		23,518	49,364	1,472,129
1993				5,288		17,145	22,433	1,494,562
1994				3,533		20,783	24,316	1,518,878
1995				5,804		13,734	19,538	1,538,416
1996[g]				1,899		5,146	7,045	1,545,461
Total	137,455	77,074	135,280	366,287	88,334	741,031		1,545,461

[a]For a summary of historical additions (1962–1984), see Table 4.6 in ref. 3. For Beatty, Richland, and Barnwell, the additions for 1985–1995 are from Table 4.19 in ref. 5. Information for 1996 is taken from ref. 7.

[b]Beatty ceased accepting LLW Dec. 31, 1992.

[c]West Valley includes a commercial state-licensed facility which opened Nov. 18, 1963, and closed Mar. 11, 1975, and an NRC-licensed facility (for on-site fuel reprocessing wastes) which opened in 1966 and continued to receive only on-site-generated LLW associated with water treatment and site cleanup until late 1986. This license is in abeyance. Disposal operations at the West Valley Demonstration Project (WVDP) have been suspended pending the preparation of an EIS report for the West Valley site closure. The WVDP began in 1980. The LLW volumes reported for 1982 through 1986 are for the WVDP only and are taken from ref. 5. Since the beginning of 1987, LLW generated at the WVDP is stored on-site in engineered facilities pending final disposal (ref. 5).

[d]Closed Dec. 27, 1977.

[e]Closed Apr. 8, 1978.

[f]These values exclude almost 19,000 m^3 (approximately 14,506 in 1980 and approximately 4,279 in 1981) of very low-level-activity settling pond sludge that was not included in the annual quota.

[g]Data presented are for Jan. 1, 1996–Sept. 30, 1996, to adjust total to a FY basis. Years prior to 1996 are calendar years.

Table 4.18. Historical annual additions and total undecayed radioactivity of LLW at commercial disposal sites[a]

Year	Radioactivity, Ci							
	Beatty[b]	West Valley[c]	Maxey Flats[d]	Richland	Sheffield[e]	Barnwell	Annual total	Cumulative total
1962	f						f	f
1963	5,690	100	22,556				28,346	28,346
1964	6,477	10,400	147,218				164,095	192,441
1965	6,377	22,600	63,828	144			92,949	285,390
1966	11,974	35,400	52,737	1,606			101,717	387,107
1967	10,894	123,100	23,273	5,378	3,850		166,495	553,602
1968	6,808	10,600	45,577	64,432	2,381		129,798	683,400
1969	9,761	36,000	31,028	55,964	2,192		134,945	818,345
1970	12,304	91,900	46,969	52,820	5,427		209,420	1,027,765
1971	4,316	436,700	720,146	23,916	7,895	4,151	1,197,124	2,224,889
1972	5,228	131,300	217,351	31,809	4,857	13,575	404,120	2,629,009
1973	5,704	346,000	118,359	57,037	2,834	48,212	578,146	3,207,155
1974	23,904	6,600	143,656	12,773	3,229	13,557	203,719	3,410,874
1975	18,388	11,600	289,570	113,341	6,103	17,428	456,430	3,867,304
1976	4,493	1,200	211,359	104,306	7,744	90,205	419,307	4,286,611
1977	23,811	900	267,063	7,465	11,147	390,121	700,507	4,987,118
1978	5,685	700		235,548	2,547	652,061	896,541	5,883,659
1979	8,897	400		164,787		314,938	489,022	6,372,681
1980	148,312	300		41,031		143,502	333,145	6,705,826
1981	52,214	229		43,905		183,744	280,092	6,985,918
1982	80,929	293		59,007		273,962	414,191	7,400,109
1983	1,356	255		120,534		383,450	505,595	7,905,704
1984	544	25		215,286		385,079	600,934	8,506,638
1985	453	39		287,849		460,571	748,912	9,255,550
1986	672	13		115,591		116,108	232,384	9,487,934
1987	3,353			42,734		211,026	257,113	9,745,047
1988	8,690			32,067		218,901	259,658	10,004,705
1989	42,678			99,056		725,164	866,898	10,871,603
1990	11,323			92,985		444,277	548,585	11,420,188
1991	29,679			158,784		611,348	799,811	12,219,999
1992	90,206			93,923		815,974	1,000,103	13,220,102
1993				31,422		611,785	643,207	13,863,309
1994				6,078		745,301	751,379	14,614,688
1995				2,836		168,981	171,817	14,786,505
1996[g]				572		287,228	287,800	15,074,305
Total	641,120	1,266,654	2,400,690	2,374,986	60,206	8,330,649		15,074,305

[a]For a summary of historical additions (1962–1984), see Table 4.6 in ref. 3. For Beatty, Richland, and Barnwell, the additions for 1985–1995 are from Table 4.20 in ref. 5. Information for 1996 is taken from ref. 7.

[b]Beatty ceased accepting LLW Dec. 31, 1992.

[c]West Valley includes a commercial state-licensed facility which opened Nov. 18, 1963, and closed Mar. 11, 1975, and an NRC-licensed facility (for on-site fuel reprocessing wastes) which opened in 1966 and continued to receive only on-site-generated LLW associated with water treatment and site cleanup until late 1986. This license is in abeyance. Disposal operations at the West Valley Demonstration Project (WVDP) have been suspended pending the preparation of an EIS report for the West Valley site closure. The WVDP began in 1980. The LLW radioactivity values reported for 1982 through 1986 are for the WVDP only and are taken from ref. 5. Since the beginning of 1987, LLW generated at the WVDP is stored on-site in engineered facilities pending final disposal (ref. 5).

[d]Closed Dec. 27, 1977.

[e]Closed Apr. 8, 1978.

[f]Reported as 296 kg of source material (as defined in Title 10, *Code of Federal Regulations*, Part 40).

[g]Data presented are for Jan. 1, 1996–Sept. 30, 1996, to adjust total to a FY basis. Years prior to 1996 are calendar years.

Table 4.19. Distribution of total volume and radioactivity, by state, of LLW shipped to commercial disposal sites during Jan. 1–Sept. 30, 1996[a]

State	Volume (m^3)	Radioactivity (Ci)	State	Volume (m^3)	Radioactivity (Ci)
Alabama	189	623	Missouri	44	104
Arizona	91	11	Nebraska	78	32,423
Arkansas	7	1	Nevada	3	<0.01
California	208	1,674	New Hampshire	<1	<0.01
Colorado	131	11	New Jersey	185	226
Connecticut	205	1,076	New Mexico	1	<1
Delaware	2	<1	New York	262	803
District of Columbia	2	<1	North Dakota	<1	<1
Florida	106	136	Ohio	110	1,137
Georgia	269	122,339	Oklahoma	1	<1
Hawaii	45	1	Oregon	1,119	339
Illinois	916	6,067	Pennsylvania	281	68,373
Indiana	7	9	Rhode Island	2	<1
Iowa	73	134	South Carolina	180	956
Kansas	22	1,600	Tennessee	600	492
Kentucky	5	215	Texas	70	2,068
Louisiana	75	254	Utah	63	<1
Maine	64	302	Vermont	<1	<0.01
Maryland	36	215	Virginia	350	1,177
Massachusetts	179	2,056	Washington	555	222
Michigan	356	41,674	West Virginia	<1	<0.01
Minnesota	41	763	Wisconsin	32	3
Mississippi	80	318			
			Total	7,045	287,800

[a] Source: ref. 7. States not shipping any LLW for disposal are not listed.

Table 4.20. Breakdown of LLW by type, volume, and radioactivity received at Barnwell and Richland during Jan. 1–Sept. 30, 1996[a]

Type of waste	Volume (m^3)	Radioactivity (Ci)
Academic	160	28
Government	753	11,115
Industrial	1,723	698
Medical	29	3
Utility	4,380	275,956
	7,045	287,800

[a]Source: ref. 7.

Table 4.21. Historical and projected cumulative volume and radioactivity summary of commercial GTCC LLW[a]

Category	1993[b] Volume (m^3)		1993[b] Radioactivity (Ci)	2035[c,d] Volume (m^3)		2035[c,d] Radioactivity (Ci)
	Unpackaged	ACA packaged[e]		Unpackaged	ACA packaged	
Nuclear utility wastes						
BWR operations	3.20	1.10	28,200	105.2	36.7	1,155,517
PWR operations	2.82	0.12	18,300	77.7	10.0	573,510
LWR operations total	6.02	1.22	46,500	182.9	46.7	1,729,027
BWR decommissioning	6.26	14.48	757,000	115.4	188.8	3,270,412
PWR decommissioning	3.98	10.32	3,086,500	398.9	570.9	30,548,517
LWR decommissioning total	10.24	24.80	3,843,500	514.3	759.7	33,818,929
Nuclear utility total	16.26	26.02	3,890,000	697.2	806.4	35,547,956
Sealed sources						
General license	0.007	0.474	1,119	0.123	8.09	18,440
Specific license	0.125	38.22	354,000	0.87	234	1,560,000
Sealed sources total	0.13	38.69	355,119	0.99	242	1,578,440
DOE-held potential GTCC waste	0	0	0	0	0	0
Other generator waste[f]	46.9	74.2	2,738	235	465	12,680
Grand total	63.3	138.9	4,247,857	933	1,513	37,139,076

[a]Based on the INEEL study of ref. 13. Projected data reported represent base-case scenario projections.

[b]Reported cumulative inventory as of December 31, 1993.

[c]Projected cumulative inventory for end of CY 2035.

[d]Reference 13 also projects quantities of nuclear utility GTCC LLW by the end of CY 2055. For the base case, these include an unpackaged volume of 1,144 m^3, an after-concentration-averaged (ACA) packaged volume of 1,347 m^3, and an associated radioactivity of 88,400,000 Ci.

[e]ACA packaged waste. This is the packaged volume of waste that is classified as GTCC LLW, after all other waste has been classified as Class A, B, or C LLW using concentration-averaging practices.

[f]Includes contributions from ^{14}C users, irradiation laboratories, sealed source manufacturers, a nuclear fuel fabrication facility, and a university reactor.

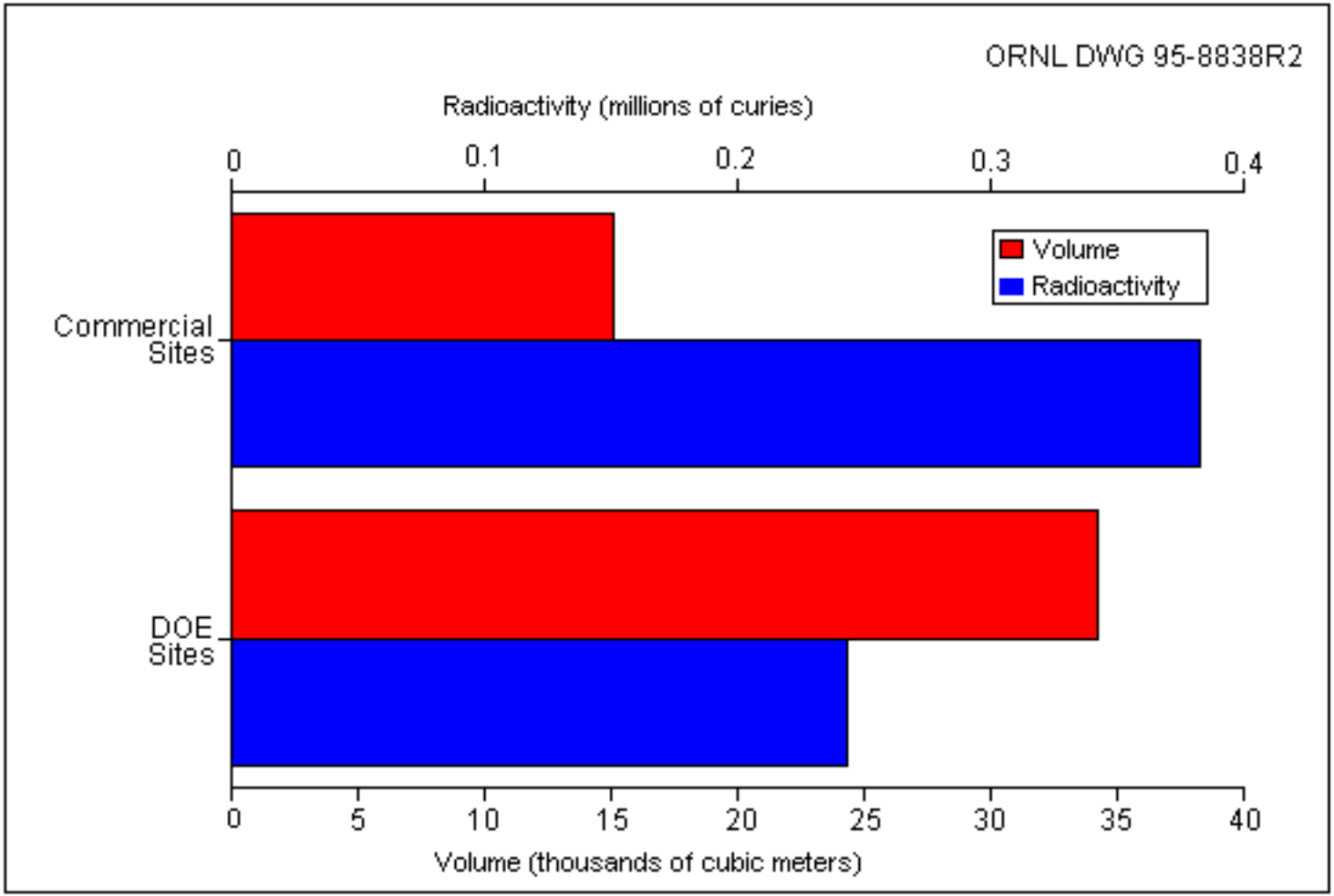

Fig. 4.1. Comparison of volume and radioactivity of LLW disposed of at commercial and DOE facilities during FY 1996.

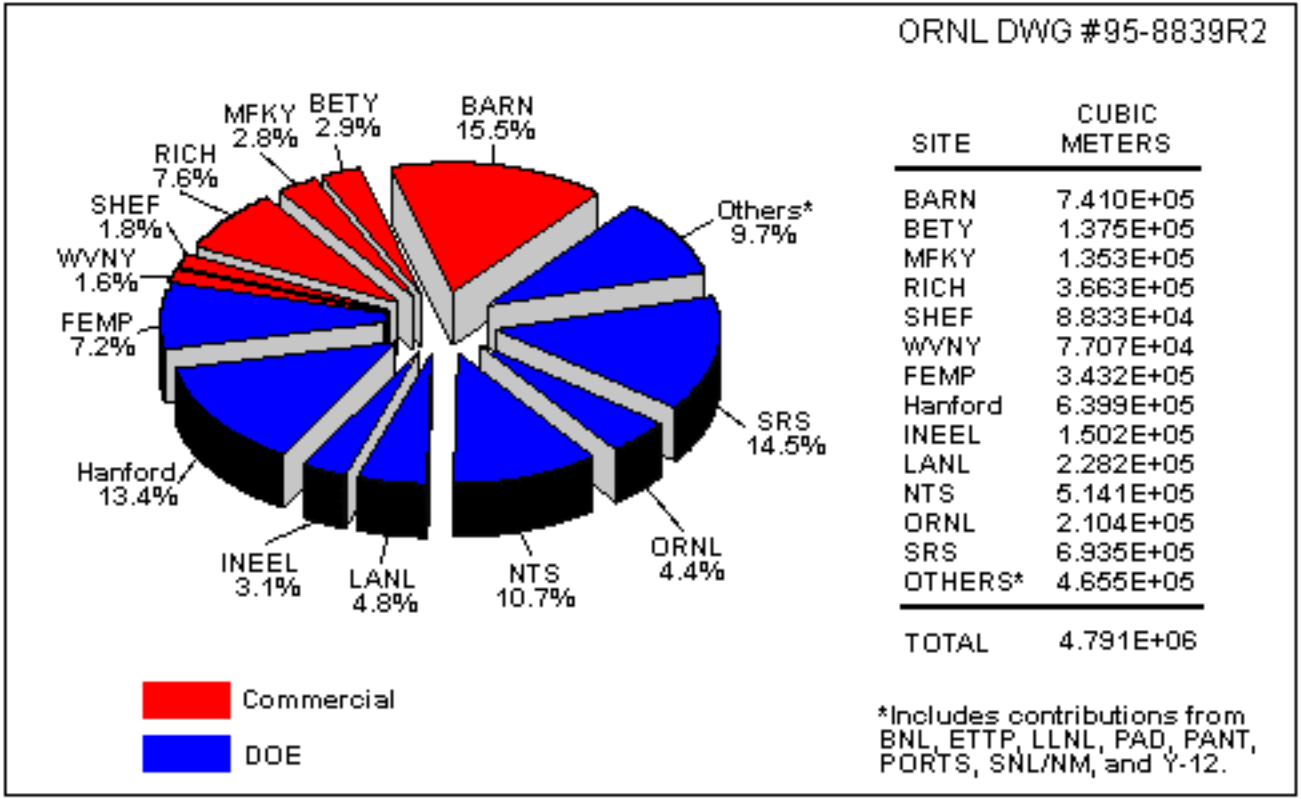

Fig. 4.2. Total volume of LLW disposed of by EOFY 1996.

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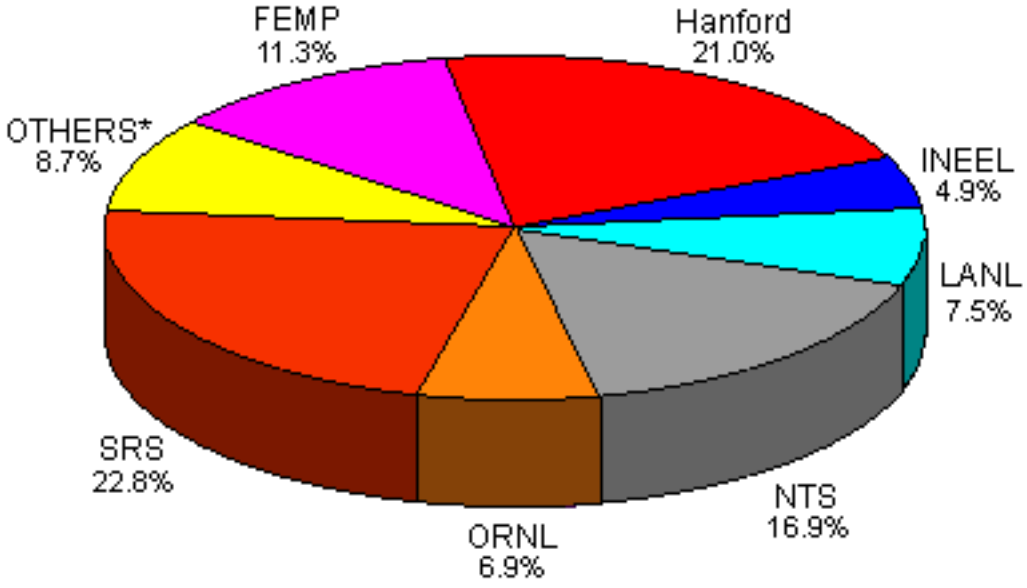

Site	Cubic Meters
FEMP	3.432E+05
Hanford	6.399E+05
INEEL	1.502E+05
LANL	2.282E+05
NTS	5.141E+05
ORNL	2.104E+05
SRS	6.935E+05
OTHERS*	2.655E+05
Total	**3.045E+06**

*Includes contributions from BNL, ETTP, LLNL, PAD, PANT, PORTS, SNL/NM, and Y-12.

Fig. 4.3. Total volume of DOE LLW disposed of by EOFY 1996.

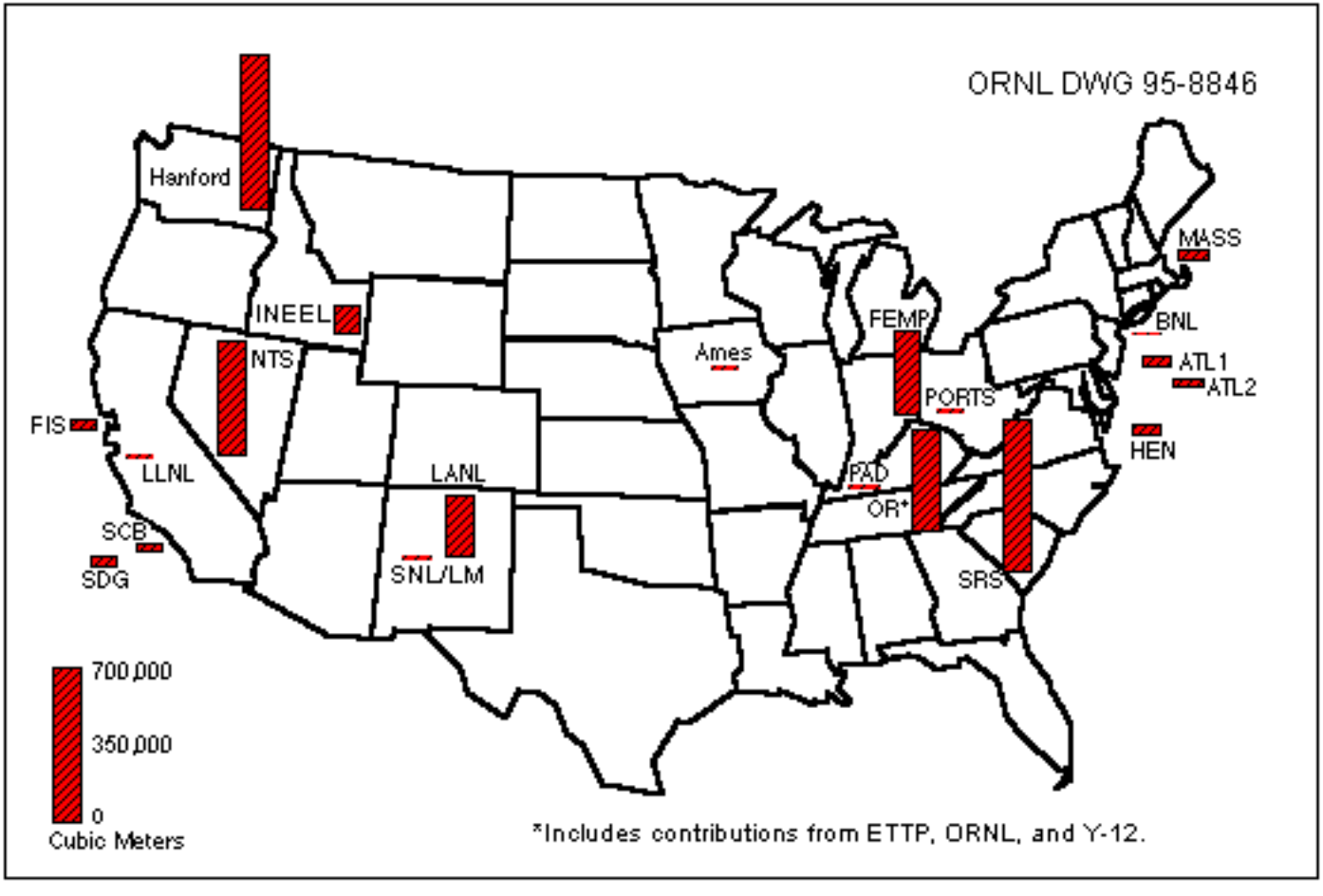

Fig. 4.4. Locations and total volumes of DOE LLW disposed of by EOFY 1996.

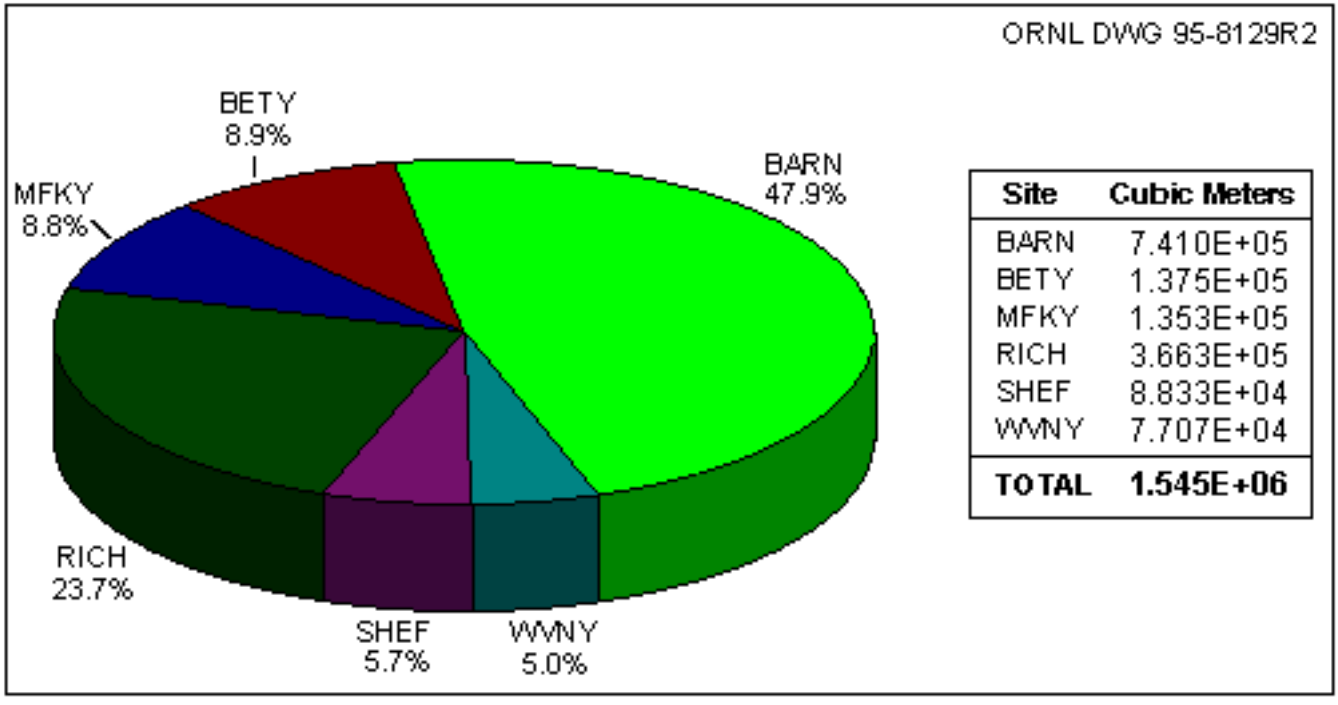

Fig. 4.5. Total volume of commercial LLW disposed of by EOFY 1996.

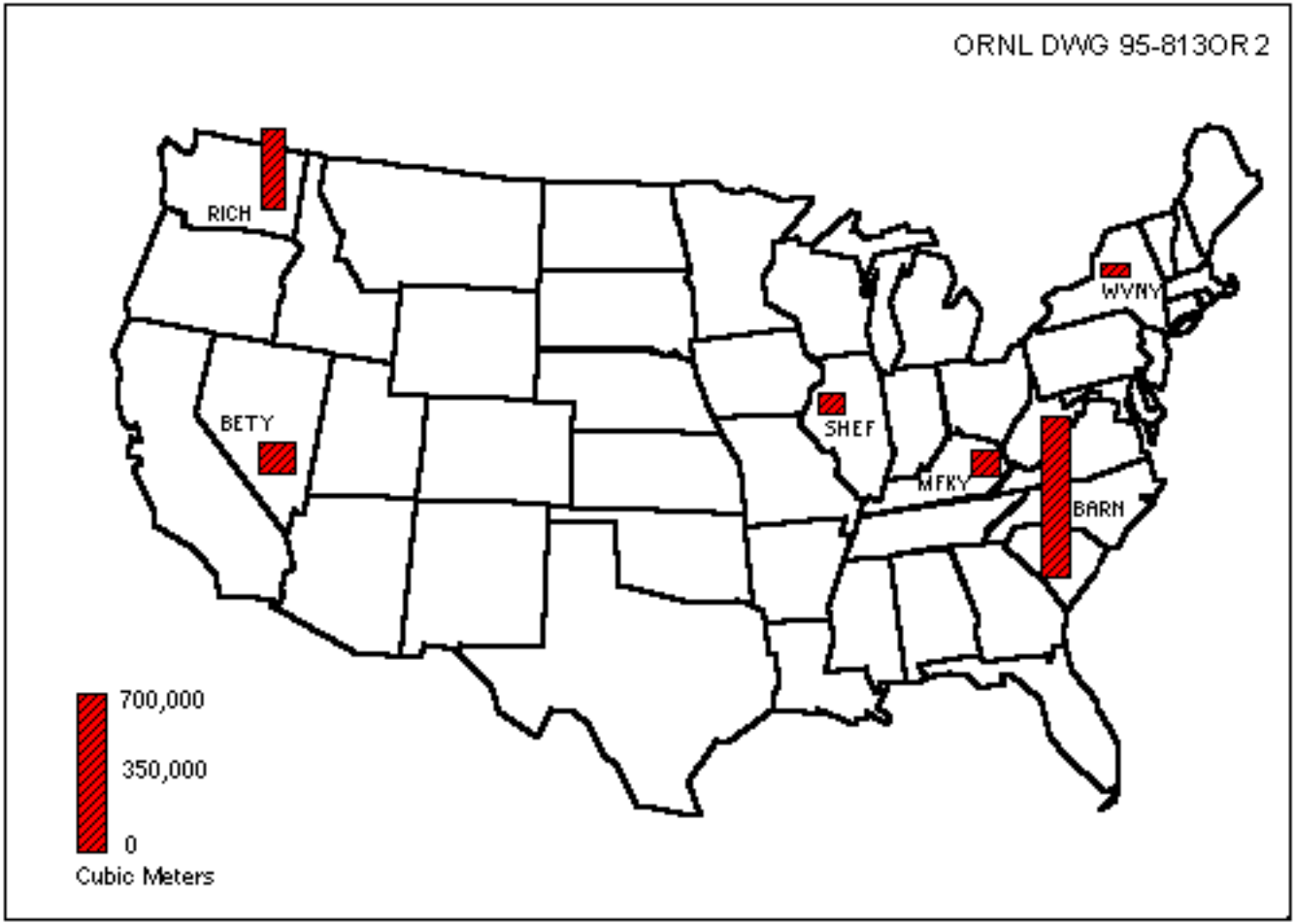

Fig. 4.6. Locations and total volumes of commercial LLW disposed of by EOFY 1996.